Table 3

Chemical Composition		Contact Hole Size (μ m)		
HF concentration	NH4F concentration	Initial Value	PL-TEOS film	O_3-TESO Film
0.5	39.6	0.5	0.53	0.60
0.25	39.8	0.5	0.53	0.55
0.12	41.0	0.5	0.51	0.52
0.10	41.0	0.5	0.51	0.51
0.09	39.9	0.5	0.51	0.52
0.09	17.0	0.5	0.52	0.57
0.09	41.0	0.5	0.50	0.51
0.03	42.0	0.5	0.50	0.50
0.001	45.0	0.5	0.50	0.50

Table 3

As shown in ~~Fig. 3~~, it will be understood that by using a chemical composition with a HF concentration of less than or equal to 0.1% by weight and a NH4F concentration in excess of 40% by weight, widening of the contact holes formed in the O_3-TEOS film and the PL-TEOS film is suppressed and it is possible to obtain the designed hole diameter.

(Embodiment 4)

Similarly to embodiment 3, 0.25 μ m contact holes were formed, and the contact hole diameter was observed using SEM after removal of a natural oxidation film using various chemical solutions, and the results are shown in Table 4.

Table 4

Chemical Composition		Contact Hole Size (μ m)		
HF concentration	NH4F concentration	Initial Value	PL-TEOS film	O_3-TESO Film
0.5	39.6	0.25	0.28	0.33
0.25	39.8	0.25	0.27	0.30
0.12	41.0	0.25	0.26	0.28
0.10	41.0	0.25	0.25	0.26
0.09	39.9	0.25	0.26	0.27
0.09	17.0	0.25	0.27	0.32

0.09	41.0	0.25	0.25	0.26
0.03	42.0	0.25	0.25	0.25
0.001	45.0	0.25	0.25	0.25

Table 4

As shown in ~~Fig. 4~~, it will be understood that by using a chemical composition with a HF concentration of less than or equal to 0.1% by weight and an NH4F concentration in excess of 40% by weight, widening of the contact holes formed in the O_3-TEOS film and the PL-TEOS film is suppressed even in the case of contact holes of 0.25 μm in diameter, and it is possible to obtain the designed hole diameter.

(Embodiment 5)

It will be shown that the number of contact hole defective regions is different depending on whether or not a surfactant is used.

Using a chemical having a HF concentration of 0.05% and a NH4F concentration of 42%, 0.5 μm contact holes were formed at 25℃, and confirmation of interference color of a remaining oxide film was carried out by light microscopy.

Thermal oxidation film : 5000 Å

Positive resist film thickness: 0.7 μm

Etching time: 20 minutes

Is surfactant added?	0.5 μm contact hole defective regions (per 1000 places)
Yes	1
Yes	0
No	277
No	95

It was confirmed that by using the surfactant, the contact hole defective regions were significantly reduced.

(Embodiment 6)

It will be shown that the number of contact hole defective regions is different depending on the added concentration of surfactant.